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Center for Chemical Process Safety

CCPS Pamphlet Series
Are You Prepared for the Coming Economic Recovery?

This pamphlet serves to alert the petrochemical industry to the impending problems that may be encountered during the economic recovery, to encourage planning to address resource gaps, and to review existing PS systems to verify their ability to handle the influx of changes that will occur.

The Center for Chemical Process Safety was established by the American Institute of Chemical Engineers in 1985 to focus on the engineering and management practices to prevent and mitigate major incidents involving the release of hazardous chemicals and hydrocarbons. CCPS is active worldwide through its comprehensive publishing program, annual technical conference, research, and instructional material for undergraduate engineering education. For more information about CCPS, please call 646-495-1371, e-mail ccps@aiche.org, or visit www.aiche.org/ccps.

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Are You Prepared for an Economic Upturn?

1. Call to action

What if you business was forced to increase 25% in the next 6-10 months? Could you manage it? Think of the equipment, personnel and planning that would require. Think a bit longer about developing a plan to accomplish this. Few people foresee an economic recovery of that magnitude in the next few years let alone months. But hidden in the workings of many companies is a threat of the same scale.

Worker demographics show several trends that concern leaders across all levels of the Petrochemical industry. The number of Baby Boomer workers who are nearing retirement, people who have reached retirement age and are waiting for a more stable economy, permanent workforce reductions and the increase in the number of contract employees filling important positions. Singly, any of these factors are manageable, however, wen considered together, they paint a scary picture for the next several years. This publication is intended to highlight some of the concerns facing the petrochemical industries in the next few years as the economy improves.
These concerns extend beyond the production and personnel issues. The challenge is to ensure that across all the upheaval of restarting or increasing production, safety is not compromised. One plant has the mantra, “Everything we do we will do safely”. The goal must be to arrive at the new operating situation without any injuries or incidents.

1.1 Introduction

“It is worth discussing radical changes, not in the expectation that they will be adopted promptly, but for two other reasons: One is to construct an ideal goal so that incremental changes can be judged by whether they move the institutional structure toward or away from that ideal. The other reason is very different. It is so that if a crisis requiring or facilitating radical change does arise, alternatives will be available which have been carefully developed and fully explored.” Milton Friedman, U.S. economist. [1]

This describes the situation the U.S. chemical manufacturing industry is in today. It is teetering on the edge of a recovery, although when it will tip into more consistent improvement is unknown. This paper will explore the various management and economic factors prevalent in the U.S. economy, how they impact process safety decisions that many companies are facing, and provide some concepts for addressing them.

1.2 Present situation

Over the years, the U.S. and many other economies have experienced various economic downturns. They may have affected only a small sector of the economy or a single region or nation's economy. In the mid-1970s the U.S. was recovering from staff reductions across many areas – production, maintenance, and support functions. Many remaining employees had been placed in positions that were not their primary skill area. At that time, as during the present "recession", 'a job was a job'. However as the economy recovered the plant began to return to pre-downturn operations, they needed to hire and train more workers. In addition, as other positions opened up in other areas, people moved onto new job responsibilities.

Today, the general economy and the petrochemical industry in general are in a similar position. When pushed for production, they must pull in more resources. This may mean hiring temporary workers or utilizing overtime to stretch the existing resources. Companies are reluctant to hire permanent resources due to the uncertain future which may result in yet another layoff. The "on again/off again" nature of a recovery can also place suppliers of material and equipment in that same operating mode.

A recent article in Chemical Engineering Progress [2] predicted growth for the U.S. economy and the chemical industry in general to be 3-5% per year. Another consistent prediction from economists is that this recovery will be slow and long in duration. On the surface this may seem to be the best situation, a steady growth rate. It is relatively easy to forecast single-digit growth and to adapt business plans production schedules and capital forecasts to meet this pace. However, what if the economists are wrong? What if the most aggressive rate of improvement is what really happens? Further consider that compounding a 3 to 5% growth rate over the course of five years produces a 16-28% percent increase. Somewhere in that period, resources and production capacity are going to be overtaxed.

The chemical industry is capital intensive, requiring specialized and expensive equipment. There is no inventory of such equipment sitting on a show room floor waiting to be installed. Lead time for large, specialized equipment can be two to five years. This means that the chemical industry must be looking ahead four to eight years. For large continuous operations such as refineries single-digit gains in productivity may be achieved by planned efficiency or de-bottlenecking efforts. For smaller specialized or batch operations, this may mean better scheduling of production campaigns or smaller efficiency improvement projects. These two scenarios are easier to plan, estimate and receive management approval. However, when small, incremental improvements no longer meet the projected demand, a major capital project and even perhaps an entirely new site may be required. Projects of this magnitude require years to design, acquire land and permits, install, check-out and eventually operate. That is why it is necessary to prepare for economic recovery before existing equipment and resources are overtaxed.

This paper is intended to spark thinking and discussion around the topic of the possibility that the economy may improve more quickly. If the common theory that the U.S. stock market leads the general economy by six to nine months, the time for planning HAS already started.

"It is generally true that, the more preparations one has for an event, the more inconveniently fast the event will occur." (Monica Fairview, Darcy Cousins, 2010) [3]

Good start-up plans are developed by a cross-functional team that knows the process and equipment well. A start-up plan requires procedures written with sufficient detail to allow operators who have not performed those tasks in many years to complete them safely. Test methods and results need to be documented in case there is a delay or change of assignment before start-up. If the economic recovery comes later than planned, a good plan for restarting processes can always be delayed and some pre-start-up activities can continue despite the delay.

2. General Approach

The difficulty in presenting this topic is that the operation of any manufacturing operation is like a spider web. A perturbation in one area affects most other areas to some degree. Other factors at work in today's economy are its global nature, "just-in-time" inventories, and a higher reliance on contractors and outsourced workers to name a few.

Also, to understand how manage this situation, we need to understand what has happened over the last several years that has made this issue much different from other economic recessions. To best dissect this, the paper will sort the issues by personnel, equipment, and materials factors.

3. Personnel Issues

For at least 10 years, the U.S. economy and others have been using a headcount mentality and have made generalizations about the "correct" number of people assigned to a given operation. Unfortunately, this may not be based on science, but on loosely related ratios (e.g. Salespeople per sales dollar or project engineers per capital budget dollar). This short-sighted thought process ignores many key risk based process safety principles such as Process Safety Knowledge, Process Management Systems, Management of Changes and Process Safety Competency. Consider the very ends of operation: When production is zero, i.e., during a turnaround or shutdown, are all employees laid off? Actually the maximum number of people working a given area probably occurs immediately before operations are on-line.

Compounding this trend is yet another aspect of the U.S. economy. Over the years, many companies have encouraged more experienced employees to consider retirement and have provided incentives for early retirement. This strategy would not have significant impacts if the company were entirely exiting a particular business and no longer needed expertise. Many companies also have a number people ready to retire as soon as their investments seem sufficiently secure. Even if the workforce is younger, a major turnover of personnel may occur as workers migrate to new positions opened by other career opportunities within or outside their current company.

Many companies may have mothballed equipment, reduced production rates and reassigned the people to different production areas. Some companies do not apply management of change to personnel issues, therefore loss of technical expertise across several years may not have been evaluated for its impact and probably not considered a threat to future production.

The unemployment rate in the U.S. has been dropping over the last two years, and stands at 5.8% at the end of 2014. [4] The current shortage of highly skilled workers will worsen. When an influx of new workers is required, a company may struggle to find sufficient workers who meet their selection criteria to fill open positions.

If the economy in general is improving, there will be increased competition for skilled laborers and the ability of contractors to supply skilled labor will decline and/or the cost of contracting will increase. One strategy is to outsource the work to a different region, in the country or offshore. However, transferring operations overseas would require even more planning and near-flawless implementation to meet a sudden increase in demand.

3.1 Personnel change backlog

Over the past three to five years, job mobility has been limited by the number of openings. As a result, when recovery begins there may be a number of employees who are looking for new opportunities either inside their company or at a different company. Expansion may create new positions and employees may be promoted. This generates more demand for entry-level positions as experienced workers move to new or different positions. There may be also a loss of experienced employees who take positions in other companies. These factors alone are difficult to predict but are obvious threats to steady operation.

3.2 Recommended personnel change actions

1. Review the seniority and job posting procedures to ensure they are robust enough to handle the expected shuffle of job openings.

2. Renew/revise the policies for promotions, job changes, etc. in the challenging employment environment. This may require discussions with labor representatives.
3. Communicate personnel policies when job change activity starts to increase so that all understand the system's function.
4. Utilize Management of Change when modifying staffing level, either up or down and when reassigning new personnel at all levels.
5. Conduct an open discussion with technical staff to spotlight their internal career options before they look elsewhere to meet their career goals.

3.3 Recruiting new personnel

3.3.1 Operations & craft skilled employees

In a perfect world, there would be a ready supply of highly trained and skilled people, just waiting to be hired. If this pool of candidates existed, could you be sure they are skilled, qualified, or willing to work for you? In many markets, there is a shortage of skilled workers, or the available people lack acceptable work histories.

3.3.2 Technical employees

All comments noted above for operations and craft-skilled personnel, also apply to technical employees. They fall into two categories – experienced and new grads; each has its pluses and minuses. Experienced technical staff come with a practiced set of skills and proven work habits. They arrive with pre- installed hazard awareness and risk acceptance that may be different from your company's. On the other hand, those skills may not be state-of-the-art. More experienced workers may be more set in their ways and less adaptable to your systems and methods.

New grads are the flip-side of the experienced engineer with less hazard/risk awareness, but more adaptable and probably have more current technical skills especially in computerized areas.

3.3.3 Recommended personnel recruiting actions:

1. Consult with the local labor representatives to determine what sources of labor exist and compare this to foreseeable labor needs.
2. Look beyond the local labor pool to find workers who can fill hourly or technical resource needs. These resources may require different orientation and training plan.

3. Use existing employees to recruit acquaintances who may be underemployed or looking for new opportunities.
4. Do not assume that new grads or new experienced workers understand your processes and hazards. They all must receive training that enables them to perform safely even if it means some redundant or repetitive training.

3.4 Personnel training

New employees will require basic training. However, if the minimum worker proficiency cannot be found, new employees may require far more training than in the past. Secondly, training resources in a company may have retired or transferred to other areas. That jeopardizes the ability to provide adequate training to a significant number of new employees.

3.4.1 Recommended training actions:

1. Inventory existing training requirements to ensure all the required training materials are still available, current, and include new training. This is also an excellent time to cull out any training that has exceeded its effectiveness.
2. Once the necessary training 'courses' have been defined, assess if sufficient resources exist inside or outside the organization to provide the courses on the required schedule.
3. Using the gaps identified in 1 & 2 above, develop a more complete training strategy that utilizes internal and external resources to meet the training needs.
4. Use Chemical Safety Board (CSB) videos [5] and other incident-based examples to increase employees' sense of vulnerability of serious events. Past incidents from your company provide the most effective hazard awareness training.
5. Set a long-term goal of establishing an e-learning system; new training materials should be developed to support this effort.

4. Equipment

Of the areas to analyze in preparation for economic recovery, the equipment issue may be the easiest. Equipment, unlike people has a nameplate capacity and can be factually evaluated for its fitness for duty. When needed, a preparation plan can be developed based on past experience and the Pre Start-up Safety Review (PSSR) checklist(s).

There are a number of industry practices that can be employed to inspect and prepare equipment. However, they are only effective if they are performed well and necessary corrective actions are taken. Some inspections are based on runtime, but others, such as corrosion may have been at work even while equipment has been idle. Despite

pressures to restart equipment, these inspections must be performed to avoid a catastrophic event or even a nuisance shutdown.

Other key areas for review are the instrumentation and control logic. All field instruments need to be tested to verify they still function as expected. Similarly, the control logic should not have changed when the process was idle, but how do you know? A vice president that I worked with had an excellent quotation, “In God we trust. All others bring data.” [6] All control logic needs a functional review that may include revisiting the initial check-out and start-up plans.

Likewise, mechanical equipment also needs to be checked out. Even basic attributes such as proper rotational direction are important. It is often difficult to determine what is critical, the most practical approach may be to check-out everything in detail.

4.1 recommended equipment actions

1. Develop a check-out and restart plan with the assistance of workers experienced in that area, even if it means moving some people back to old positions temporarily.
2. Equipment that has been inactive for months or years doesn’t magically repair itself. Review repairs and inspections that may have been deferred and address them as part of the re-start/start-up plan.
3. Cost-cutting measures over previous years may have led to “cannibalization” of equipment, spare parts or components. Verify spare parts inventories along with the inspection procedures.
4. Revisit PHAs as part of the re-start efforts and use hazard identification techniques to evaluate start-up activities.
5. Never assume an erroneous reading is ‘just a bad instrument’. Restarting equipment may take the process into territory it has not experienced recently. Start-up procedures need to provide remedial action for when the system is outside the expected range.
6. Renew operating procedures and training for equipment that has been inactive for longer than a few months.
7. Include mitigative safeguards and equipment in the restart plan since a higher risk of leaks, spills or off-spec material occurs during start-up.

5. Materials

During the time since full scale production, materials in storage have aged and their potency changed. If tanks or pipelines have been used for other material over a

shutdown period, residual contaminants or cleaning materials may still be present. Flushing and testing of the lines may seem like overkill, but in reality it is cheap insurance against quality issues, a major process upset, or worse.

Suppliers that provided key raw materials may have gone out of business or altered their range of products. That key material once readily available may require the supplier to restart their process and mothballed equipment. For certain materials, the manufacturing location may have changed, and subtle differences may exist even though the containers are still labeled the same way.

When new sources of raw materials are required, they need particular evaluation. One of the best evaluation methods is to progress from lab scale through pilot scale evaluations before making a full scale material change. Leaks, spills and off-spec material may cause new and/or different waste streams. Like other suppliers, waste handling contractors will need to be ready and capable of handling the influx of wastes.

5.1 recommended material actions

1. Do not assume that materials in inventory retain the same potency as when initially purchased; test and confirm. Lower potency may not correlate to lower reactivity; inhibitors and stabilizers also lose effectiveness over time.
2. Verify past suppliers are still viable and are prepared to meet your renewed demand.
3. Where necessary, use the company's practices to screen new suppliers and to verify the quality of their products. This may take several iterations to successfully complete.
4. Any material changes including different vendors should receive a thorough Management of Change (MOC) review.
5. Be prepared to handle new and different waste streams during cleaning, checkout and start-up. This includes collection, storage, and disposal.
6. When inventorying raw materials, verify that spill response chemicals and equipment are also at proper levels and locations.

6. Conclusions

1. "Better to prepare and prevent than repair & repent" – Ezra Taft Benson U.S. Secretary of Agriculture
2. "Before anything else, preparation is the key to success". Alexander Graham Bell U.S. (Scottish-born) inventor (1847 - 1922)

3. The ability to react quickly and correctly to the future depends on the degree of anticipation and preparation that can be made in advance.
4. After years of being reduced funding, funding proposals may be more easily approved. Therefore, be careful what you ask for; you just might get it.
5. Your suppliers may also struggle with the same restart and resource issues. Use extra diligence to avoid problems that been noted earlier in this paper.

7. References

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